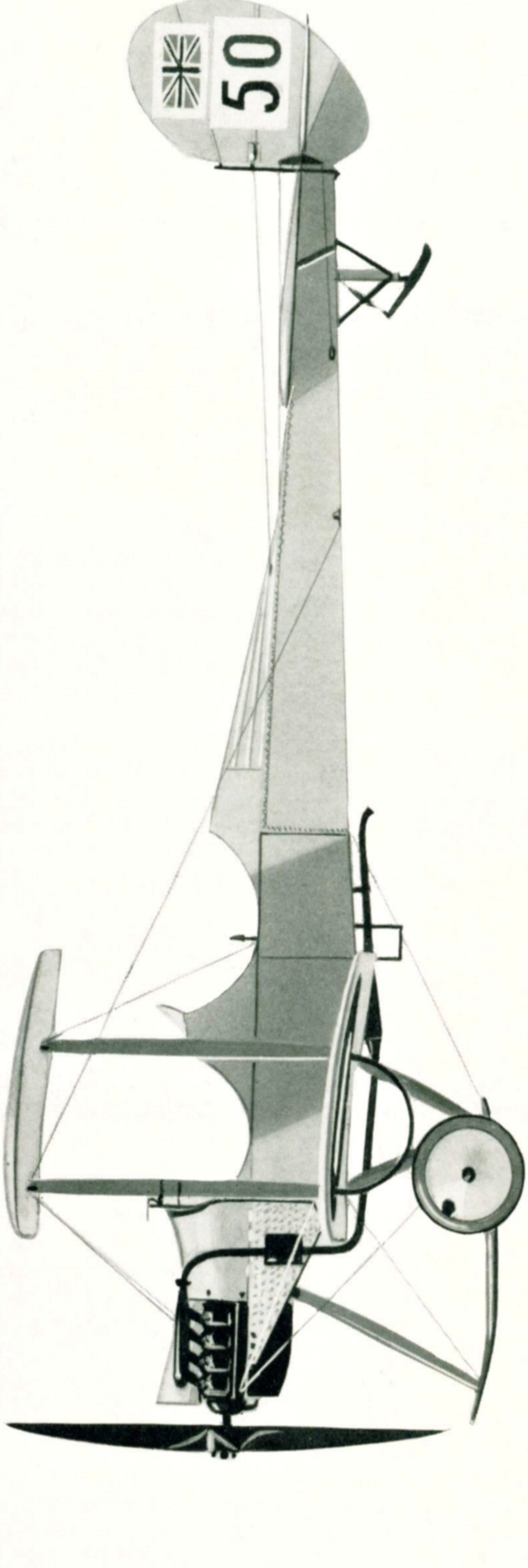
PROFILE PUBLICATIONS

The B.E.2, 2a & 2b



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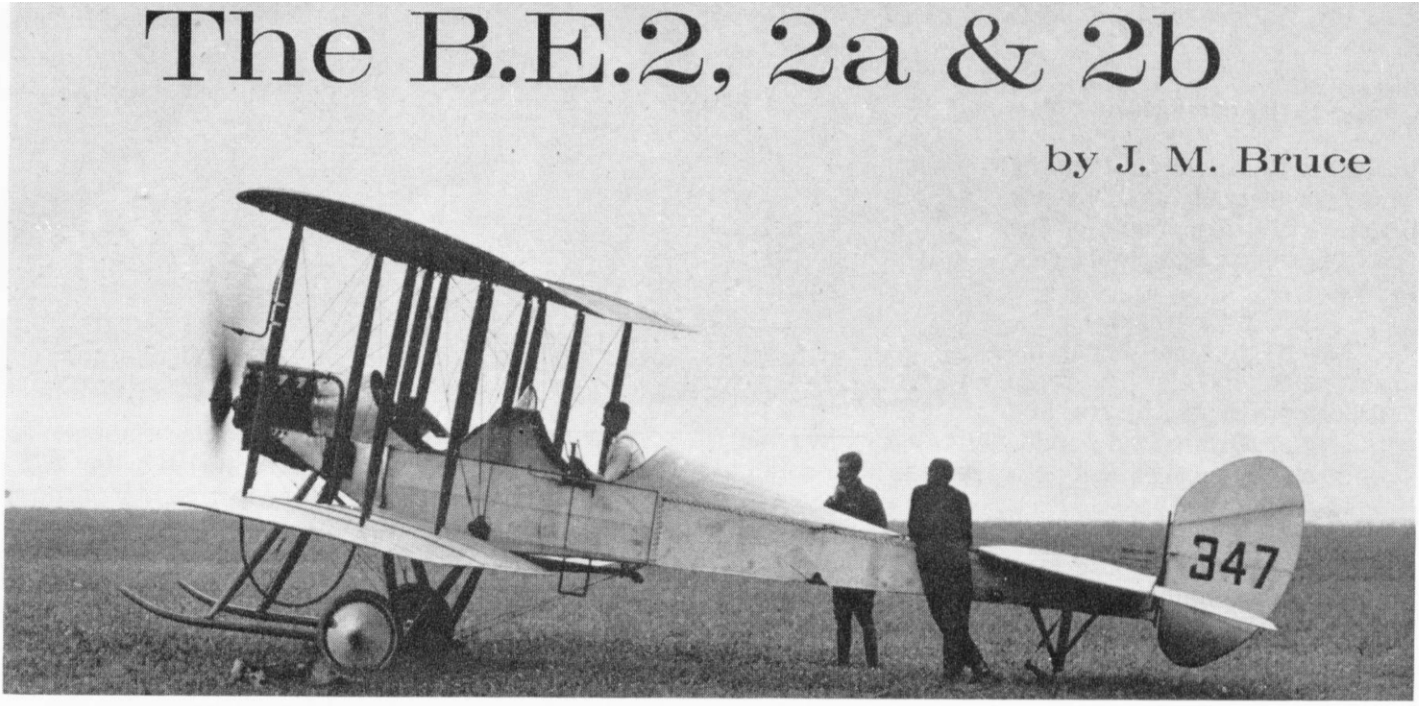
The B.E.2, 2a & 2b

by J. M. Bruce



No. 347, the B.E.2a of No. 2 Squadron that was the first British aircraft to land in Europe after the outbreak of war. Flown by Lt. H. D. Harvey-Kelly, it landed near Amiens at 8.20 a.m. on 13th August 1914. (Photo: Flight International 0212)

In its issue dated 6th January 1912 the journal *Flight* printed this news item:

> **"New Army Aircraft Factory Aeroplane**
>
> **The painstaking but very energetic research that progresses at the Army Aircraft Factory, under the superintendence of Mr. Mervyn O'Gorman, has resulted in another experimental aeroplane taking the air. The machine—from what we are allowed to see of it at the polite distance of a spectator among the casual public that frequents the Plain on the 'off chance'—is a large biplane with an absolutely silent engine. It has been said that it is a remodelled version of the Duke of Westminster's old Voisin, but it seemed to us that there was more remodelling than anything else, and everything that one could see about the machine was of singular interest. In the control, the entire wing surfaces seem to be warped, which appears to give exceedingly powerful balancing action for the maintenance of lateral equilibrium. The detail construction also gives evidence of extreme care, and the application of the principle of streamline form together with the complete absence of visible rigging wires in the tail are both points worthy of comment. The engine is evidently a Wolseley, and has the propeller in front. A rough guess at the speed would place this figure at about 60 m.p.h. The gliding angle seems to be very fine too, as far as one can judge of these things by the eye. The propeller is of the four-bladed type; and, apart from the silence of the power plant, another feature of especial importance is the fact that the engine can be started from on board. Mr. G. de Havilland has been acting as pilot with great success, and among the passengers has been the superintendent of the factory, whose object in this aeroplane construction work, it may be as well to emphasize once more, is research, not competitive manufacture. In fact, we believe the inclination of the officials is to give British constructors who are building military machines access to the information obtained by means of this research work."**

Two weeks later *Flight* published an illustration of the new aircraft. This showed it to be a two-bay tractor biplane of clean design, bearing no resemblance whatever to the Voisin from which it was allegedly rebuilt.

In fact the only connections between the Army Aircraft Factory's new creation and the Voisin were the 60 h.p. Wolseley engine, its radiator and petrol tank, and the lower wing-root fittings. At that time the staff of the Factory had no authority to design and construct aeroplanes but, not unnaturally, keenly wished to do so. In December 1910 a Blériot monoplane was returned for repair to Farnborough from Larkhill on Salisbury Plain, where the War Office had at that time an embryonic flying establishment. In requesting from the Master General of Ordnance the necessary authority for the repair work the staff of the Factory asked that it should cover reconstruction. This authority was granted in January 1911, and so liberally did Mervyn O'Gorman's men interpret the term "reconstruction" that when the aircraft ultimately emerged it was completely metamorphosed into a peculiar canard pusher biplane that was later designated Santos Experimental No. 1, or S.E.1.

As this subterfuge had proved successful, a similar request to the Master General of Ordnance was made when, in April 1911, the Voisin that had been presented to the War Office by the Duke of Westminster was sent to the Factory for repair. The new biplane that was completed in the autumn of 1911 was designed by Geoffrey de Havilland and F. M. Green.

The "reconstructed" Voisin was given the designation B.E.1 signifying Bleriot Experimental. It was, in its day, an advanced design and represented a great stride forward by Geoffrey de Havilland from his primitive pusher designs and the rather outlandish S.E.1, with which he had been associated.

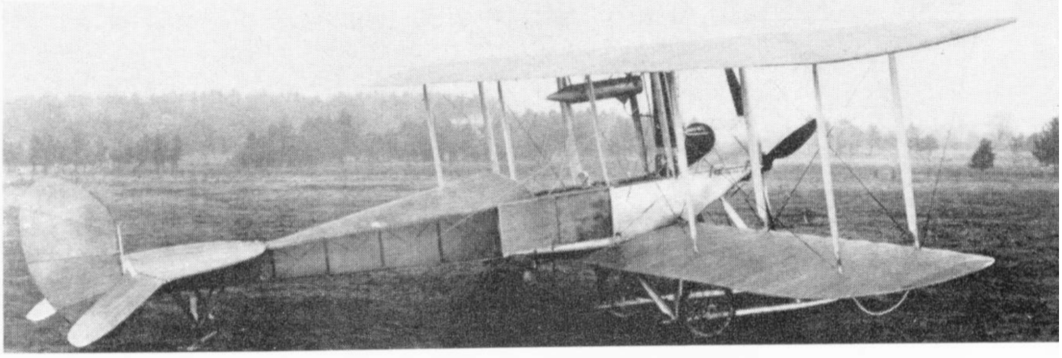
As originally built, the B.E.1 had no dihedral. The extensions of the upper wings were somewhat longer than those of the lower, and were braced by a single lift cable from the base of the forward outer interplane strut on each side. As lateral control was by wing warping there was no incidence bracing; the planform of the wing-tips was semi-elliptical.

The shallow fuselage was a wire-braced wooden structure with a rounded top-decking behind the rear seat. There were two seats in tandem but there was no top-decking between them; the pilot sat in the rear position. The Wolseley engine, a water-cooled V-eight, had an open-fronted bonnet over it, and a large rectangular radiator was mounted vertically immediately ahead of the forward centre-section struts, where it must have interfered badly with the crew's field of view.

In the tail assembly there appeared the characteristic ear-shaped rudder that was to remain standard on the many thousands of descendants of the B.E.1. It was made of steel tubing, as were the elevators; there was no fin and the steel-tube rudder post stood in seemingly perilous cantilever starkness, without bracing of any kind. The tailplane was of composite construction and was attached externally to the upper surface of the top longerons.

Silencers were fitted to the engine, and the B.E.1 became known as the Army Silent Aeroplane. It made its first flight on 1st January 1912, whereafter it was tested and flown extensively at Farnborough and was

The first B.E. biplane as it was in January 1912.
(Photo: Flight International 17751)



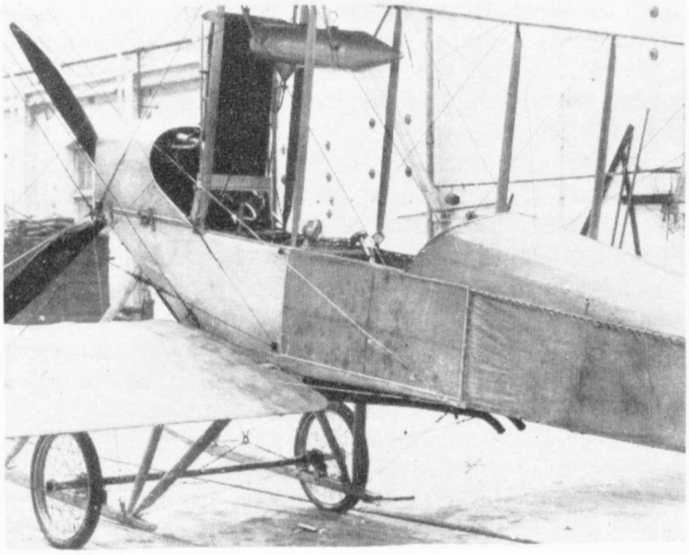
probably the first aircraft in the world to have any kind of certificate of airworthiness. The text of this document is as follows:

> **"B.E.1 Certificate**
>
> This is to certify that the aeroplane B.E.1 has been thoroughly tested by me, and the mean speed over a ¾-mile course with a live load of 25 stone and sufficient petrol for one hour's flight is 58–59 m.p.h.
>
> The rate of rising loaded as above has been tested up to 600 ft., and found to be at the rate of 155 feet per minute.
>
> The machine has been inverted and suspended from the centre and the wings loaded to three times the normal loading. On examination after this test the aeroplane showed no signs of defect.
>
> (Signed) S. Heckstall Smith,
> For Superintendent, Army Aircraft Factory.
> *14th March 1912*, South Farnborough."

The B.E.1 had a long and useful life. It made more than 140 flights with the Wolseley engine as its power unit, during which period of its existence it was fitted with an enlarged tailplane and a modified gravity tank, and a small amount of dihedral was added to the mainplanes. The Wolseley engine was later replaced by a 60 h.p. Renault, an air-cooled V-eight that altered the nose configuration of the aircraft and gave the crew an improved forward view.

Several "firsts" can be claimed for the B.E.1. In the light of later events few were more significant than its use, as early as January 1912, in some of the first experiments with wireless equipment installed in an aeroplane. This equipment had been designed and made by W. Widdington, who had joined the staff of the Army Aircraft Factory from Cambridge. With Captain H. P. T. Lefroy, R.E., as observer, Geoffrey de Havilland flew the B.E.1 in the first successful wireless-controlled artillery shoot over Salisbury Plain. In May 1912 the B.E.1 was fitted with a generator driven by the engine via a length of bicycle chain; this installation was made by Captain Lefroy.

This photograph of the cockpit of B.E.1 is said to have been made in October 1911. If the date is correct the aircraft must have been in existence for some three months before it was revealed to the public. (Photo: Crown copyright)

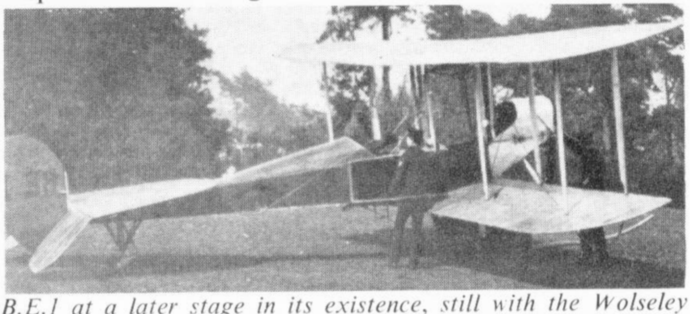


When the official system of serial numbers for R.F.C. aircraft was introduced in 1912 the B.E.1 became No. *201*. It was used for experimental purposes at Farnborough and was also flown by No. 2 Squadron, R.F.C., in which unit it was frequently piloted (and occasionally crashed) by the Commanding Officer, Major C. J. Burke. Another distinguished member of No. 2 Squadron who flew *201* regularly was Lt. C. A. H. Longcroft. By the summer of 1913 the aircraft was with No. 4 Squadron.

The official history, *The War in the Air*, can seldom be faulted, particularly in matters of fact, but it is in error in its reference to the demise of B.E.1. In Vol. I, page 254, Sir Walter Raleigh wrote:

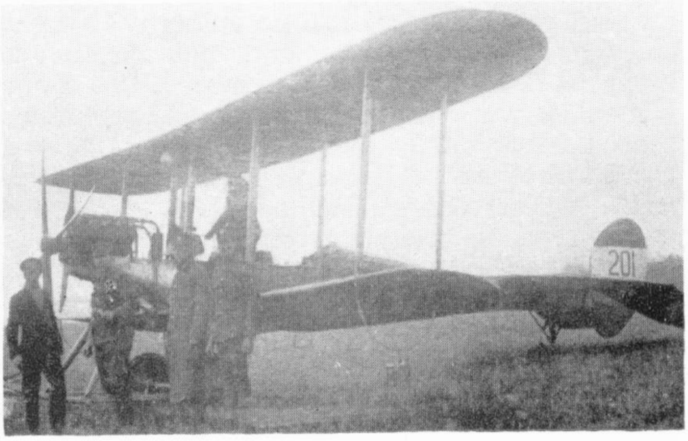
> "When at last it was wrecked, beyond hope of repair, in January 1915, it had seen almost three years of service and had perhaps known more crashes than any aeroplane before or since. It was frequently returned to the factory for the replacement of the undercarriage and for other repairs. The first machine of its type, it outlived generations of its successors, and before it yielded to fate had become the revered grandfather of the whole brood of factory aeroplanes."

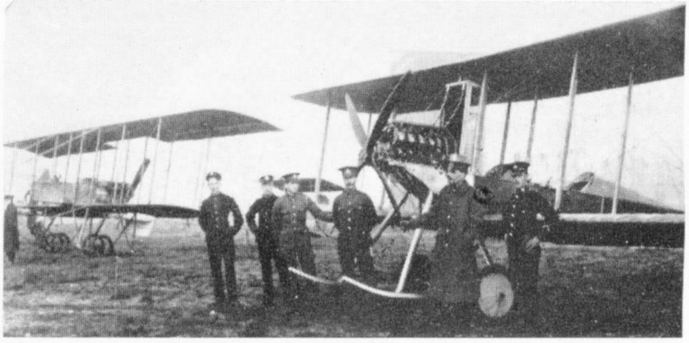
It is possible that *201* may have been damaged in January 1915, but its identity was not then lost, for a B.E. still bearing that number was in existence in May of that year. On 14th April 1915 it had been inspected following reconstruction at the Royal



B.E.1 at a later stage in its existence, still with the Wolseley engine but with enlarged tailplane and dihedral on the mainplanes.

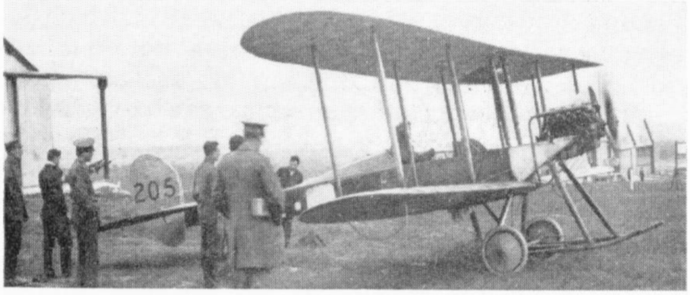
B.E.1 as No. 201 *of the Royal Flying Corps, fitted with a Renault engine in place of the original Wolseley.*
(Photo: H. F. Cowley)





The fifth B.E. biplane, originally known as B.E.5, had a 60 h.p. E.N.V. Type F engine. It had the official serial number 205.

With its E.N.V. engine replaced by a 70 h.p. Renault, No. 205 *was indistinguishable from B.E.2. It is here seen with No. 2 Squadron at Montrose in May 1913, shortly before it broke up in the air, killing Lt. Desmond Arthur.*
(Photo: Imperial War Museum Q 66827)



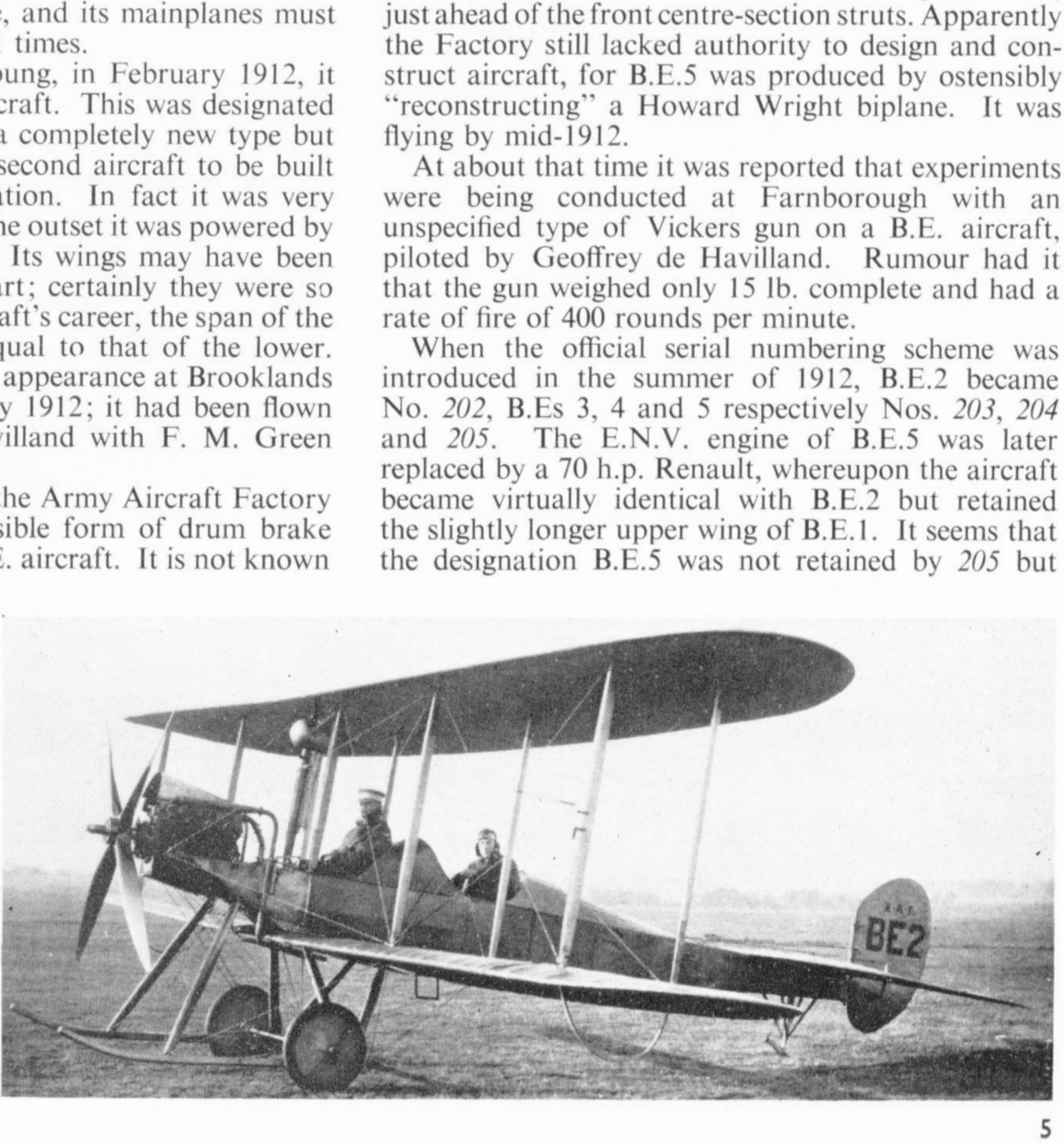
Aircraft Factory, its instruments comprising compass No. 167, clinometer No. 98, rev. counter No. 15017, altimeter No. 6278 and air-speed indicator No. 457. No. *201* was still flying on 5th May 1915.

By that time little of the original structure could have remained. Certainly at a late stage in its career No. *201* had a B.E.2b-type fuselage, and its mainplanes must have been replaced several times.

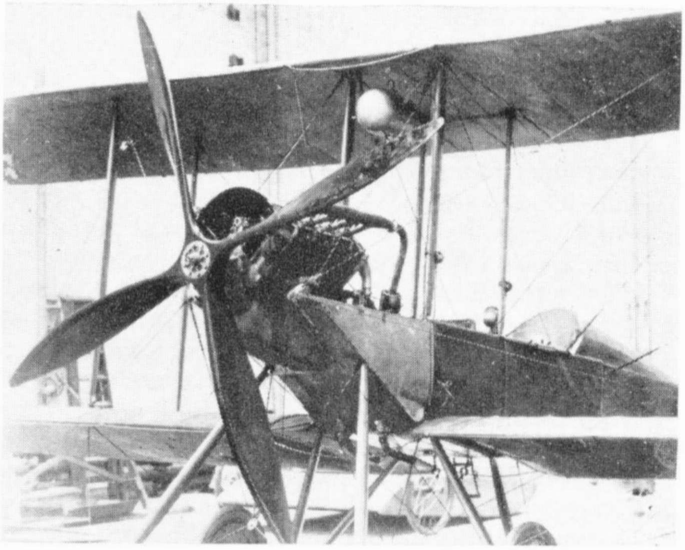
When B.E.1 was still young, in February 1912, it was joined by a second aircraft. This was designated B.E.2, not because it was a completely new type but simply because it was the second aircraft to be built in the basic B.E. configuration. In fact it was very similar to B.E.1, but from the outset it was powered by a 70 h.p. Renault engine. Its wings may have been of equal span from the start; certainly they were so at an early stage in the aircraft's career, the span of the upper wing being made equal to that of the lower. B.E.2 made an early public appearance at Brooklands on Saturday, 24th February 1912; it had been flown there by Geoffrey de Havilland with F. M. Green as his passenger.

As early as March 1912 the Army Aircraft Factory designed a simple but sensible form of drum brake for use on the wheels of B.E. aircraft. It is not known why this was not developed, but no doubt it was considered that landing speeds were so low and power loadings so high that the additional weight could not be justified.

A float undercarriage was designed for the aircraft, but evidence that this was made has yet to be found.



Possibly the same aircraft, but with decking behind the front seat and wholly external exhaust pipes. The wings were of equal span.
(Photo: Real Photographs Co.)



B.E.2 at an early stage in its existence, with the exhaust pipes passing inside the fuselage behind the engine. At this time there was no decking separating the seats. (Photo: Crown copyright)

The third and fourth aircraft in the B.E. category, designated B.E.3 and B.E.4, were powered by Gnome rotary engines and were quite different from B.E.1 and B.E.2. The fifth B.E. reverted to the original-type airframe but was designed to have the 60 h.p. E.N.V. engine. As the fifth of the series it was originally known as B.E.5 and is so described on contemporary drawings. Its eems likely that it was intended to fit the E.N.V. engine to a further B.E., which would have been B.E.6, but it is not known whether this was done. The E.N.V. was a water-cooled engine, so the new B.E. had a tall rectangular radiator mounted, as on the original B.E.1, just ahead of the front centre-section struts. Apparently the Factory still lacked authority to design and construct aircraft, for B.E.5 was produced by ostensibly "reconstructing" a Howard Wright biplane. It was flying by mid-1912.

At about that time it was reported that experiments were being conducted at Farnborough with an unspecified type of Vickers gun on a B.E. aircraft, piloted by Geoffrey de Havilland. Rumour had it that the gun weighed only 15 lb. complete and had a rate of fire of 400 rounds per minute.

When the official serial numbering scheme was introduced in the summer of 1912, B.E.2 became No. *202*, B.Es 3, 4 and 5 respectively Nos. *203*, *204* and *205*. The E.N.V. engine of B.E.5 was later replaced by a 70 h.p. Renault, whereupon the aircraft became virtually identical with B.E.2 but retained the slightly longer upper wing of B.E.1. It seems that the designation B.E.5 was not retained by *205* but was re-allocated to a rotary-powered development of B.E.3 and 4. It must therefore have been at this point that the designations came to signify type numbers instead of series numbers.

The War Office had announced its intention of holding a competition in the late summer of 1912 with the object of selecting the best available aircraft for the Royal Flying Corps. It was to be expected that a production order would be given for the successful type. The contest is one of the great highlights in the early history of British military aircraft and became known as the Military Trials. It attracted a total entry of thirty-one aircraft from twenty manufacturers.

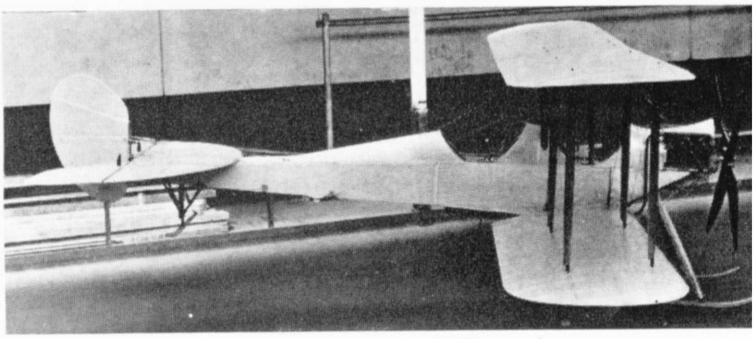
None of the aircraft designed and built at the Royal Aircraft Factory was allowed to enter for the competition. All histories give as the reason for their exclusion the facts that they were official designs and that Mervyn O'Gorman, the Superintendent of the Factory, was one of the judges. But it seems clear that the clandestine origin of the B.E.s had been accepted, however tacitly, by the War Office at least three months before the Military Trials began for, notwithstanding the imminence of the contest and the great hopes of the various designers whose products were under scrutiny, the War Office had given to Vickers Ltd. a contract (No. A.1147) for four aircraft of the B.E.2 type as early as 31st May 1912. Although Vickers were competing in the Military Trials they did not object to being given the B.E. contract; and in fact it did not mean that the B.E.2 was being in any way specially favoured, for in March 1912 four Flanders monoplanes and three Avro biplanes had been ordered for the R.F.C.

It is worth noting, in the interests of history, that the Royal Aircraft Factory did not itself produce any of the B.E. types in quantity: its total output, apart from B.E.1 and B.E.2, amounted to no more than five B.E.2a's built in 1913. This is of some importance in view of the obloquy relentlessly and indiscriminately heaped on the Factory by certain vociferous critics who saw it as the arch-enemy of the nascent aircraft industry. The criticism directed against the Royal Aircraft Factory was strongly biased, ill-informed and largely inaccurate, and occasionally naïve in its blatant and clamorous anxiety to condemn at all costs. The Factory did indeed have its faults and its failures but, in 1912-13 at least, the efforts and products of the staff there did not deserve the almost unrelieved barrage of petty sneers, innuendo and occasional fatuities that were presented as informed comment but detract materially from the historical value of the writings of the self-appointed (and not particularly well qualified) critics.

The good sense of the War Office decision to order the B.E.2 was doubly proved at the Military Trials, which were held at Larkhill during August 1912. Although not a participant, B.E.2 was flown *hors concours* by Geoffrey de Havilland in several of the tests and demonstrated clearly that it was the best all-round aircraft at Larkhill. On 12th August, with Major F. H. Sykes as passenger, he flew B.E.2 to a height of 10,560 ft. in a time of 45 minutes. This constituted a new British altitude record at the time. Secondly, the nature of the tests and the excellence of the 120 h.p. Austro-Daimler engine gave first place in the contest to S. F. Cody's biplane which, even in the pre-war circumstances of 1912, could not be considered seriously for the equipment of any military flying service.

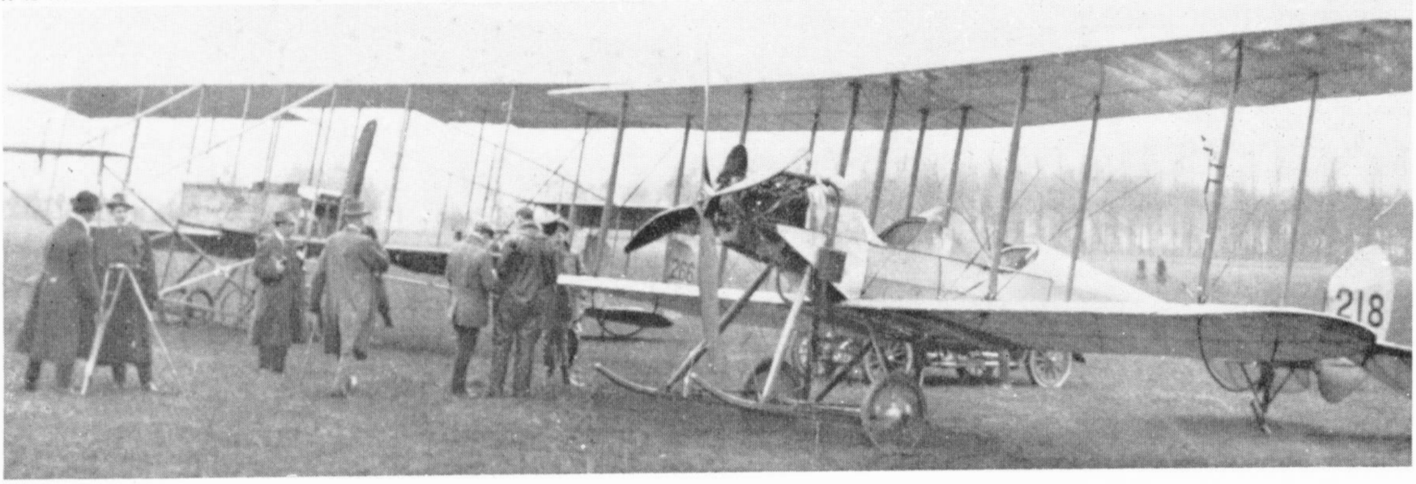
The precise time at which the designation B.E.2a was introduced is uncertain. It appears on Royal Aircraft Factory drawings dated 20th February 1912, which depict an aircraft with unequal-span wings but no dihedral. The earliest production aircraft delivered from contractors had unequal-span wings, as exemplified by *218* and *242*, but they differed from B.E.2 in having a revised fuel system and a short decking, immediately behind the engine, that gave the passenger a certain amount of protection. A little later inter-cockpit decking was also provided. The revised fuel system was probably the reason for the sub-type number B.E.2a. Ultimately, equal-span wings were standardized for B.E.2a's, and aircraft that had been built with the longer upper wing were modified in service.

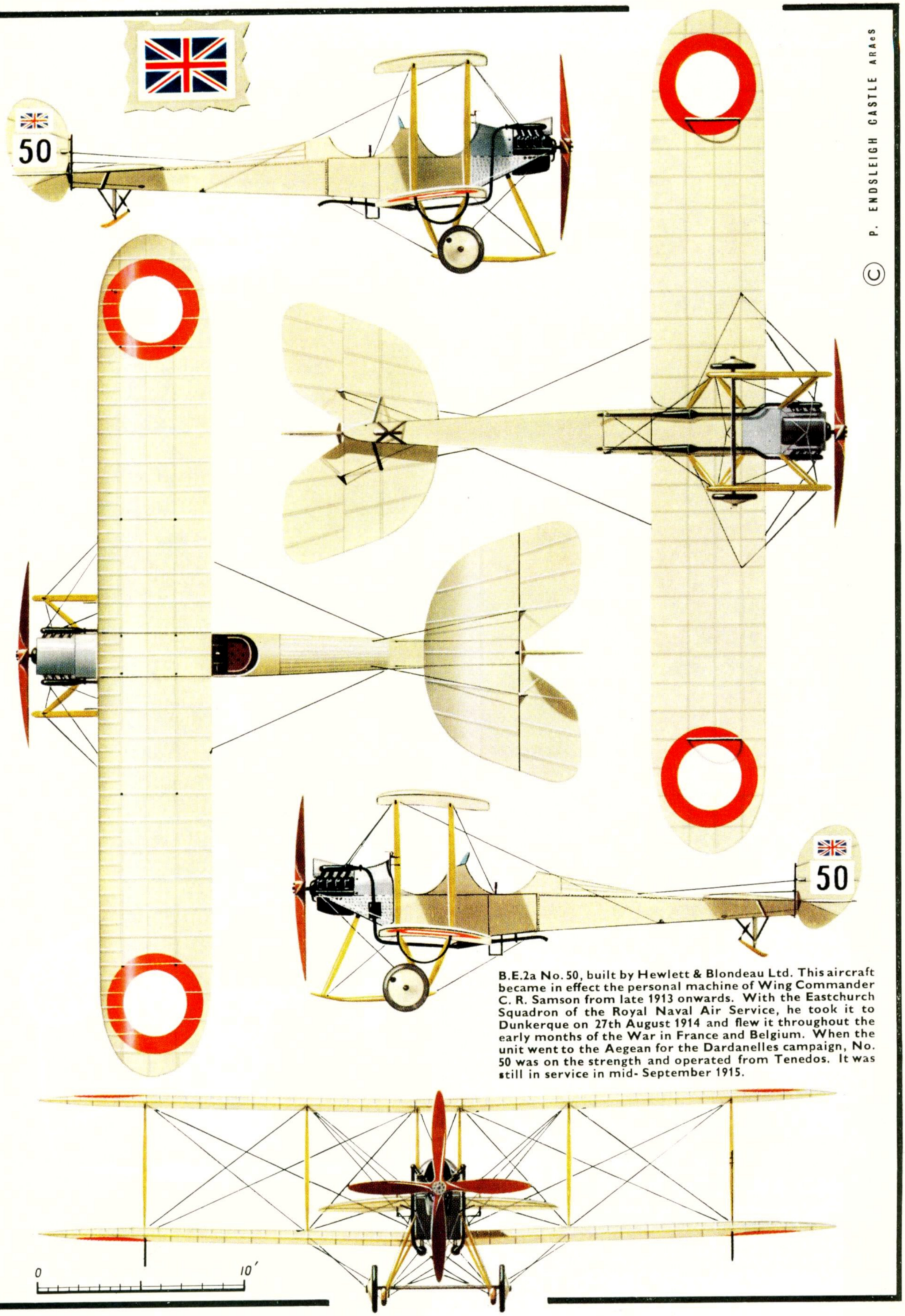
Contractor-built B.E.2a's began to appear early in 1913. Those ordered from the British and Colonial Aeroplane Co. may have been the first to enter service; certainly *217* and *218* were with No. 2 Squadron in February 1913. The first Vickers-built B.E. was delivered in the same month. The Royal Aircraft Factory's small contribution of five B.E.2a's has been mentioned above, and later contracts were



The first B.E.2a built by the Armstrong Whitworth company.

The Maurice Farman S.7 No. 266 *and Lt. Longcroft's B.E.2a No.* 218 *at York on 21st February 1913, during No. 2 Squadron's flight to its new station at Montrose. No.* 218 *is here seen in its original form as a two-seater with unequal-span wings. On page 11 it is illustrated in its modified form for Captain Longcroft's record-breaking flight of 22nd November 1913.*





B.E.2a No. 50, built by Hewlett & Blondeau Ltd. This aircraft became in effect the personal machine of Wing Commander C. R. Samson from late 1913 onwards. With the Eastchurch Squadron of the Royal Naval Air Service, he took it to Dunkerque on 27th August 1914 and flew it throughout the early months of the War in France and Belgium. When the unit went to the Aegean for the Dardanelles campaign, No. 50 was on the strength and operated from Tenedos. It was still in service in mid-September 1915.

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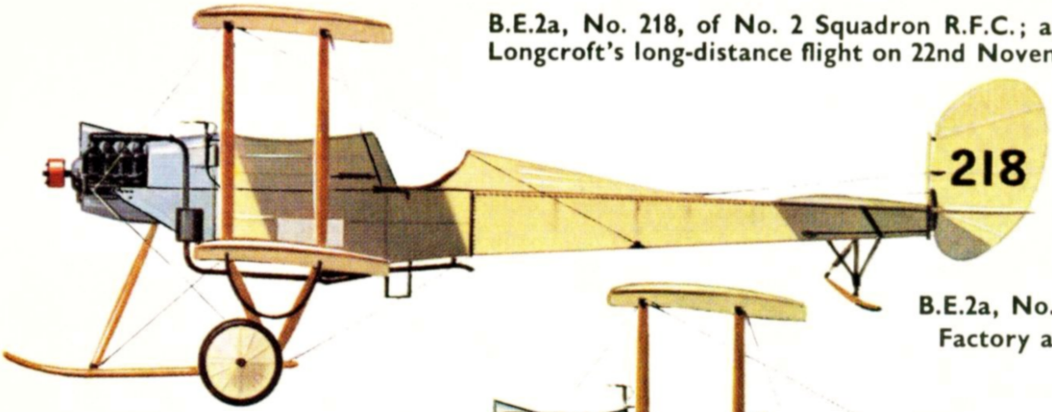
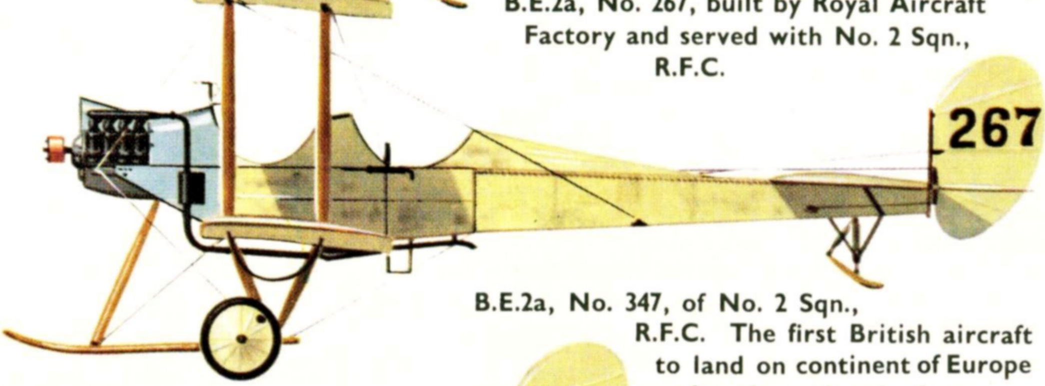
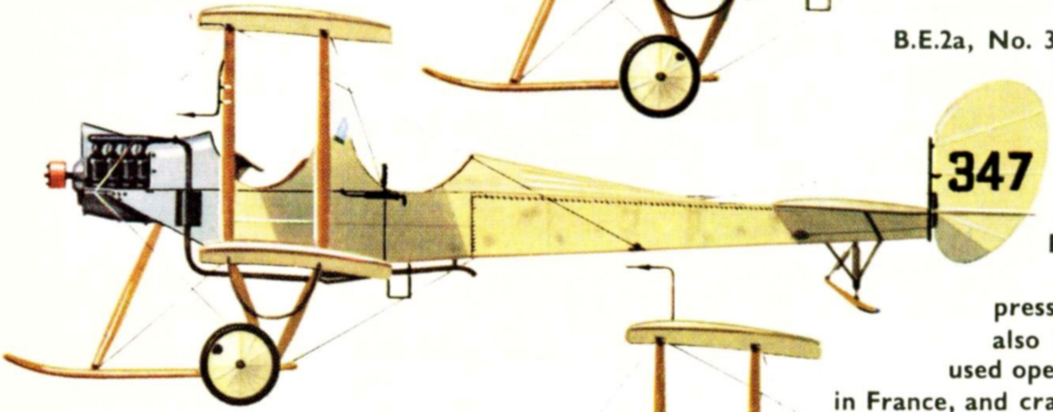
B.E.2a, No. 218, of No. 2 Squadron R.F.C.; as modified for Capt. C. A. H. Longcroft's long-distance flight on 22nd November 1913.



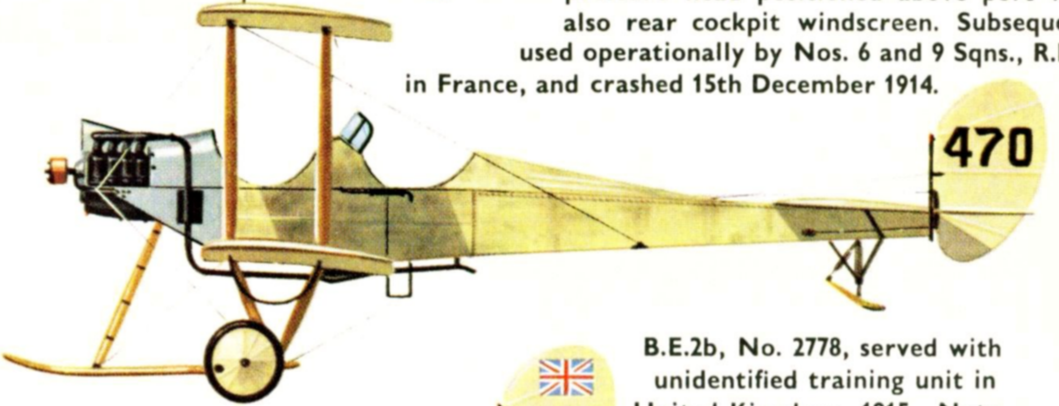
B.E.2a, No. 267, built by Royal Aircraft Factory and served with No. 2 Sqn., R.F.C.

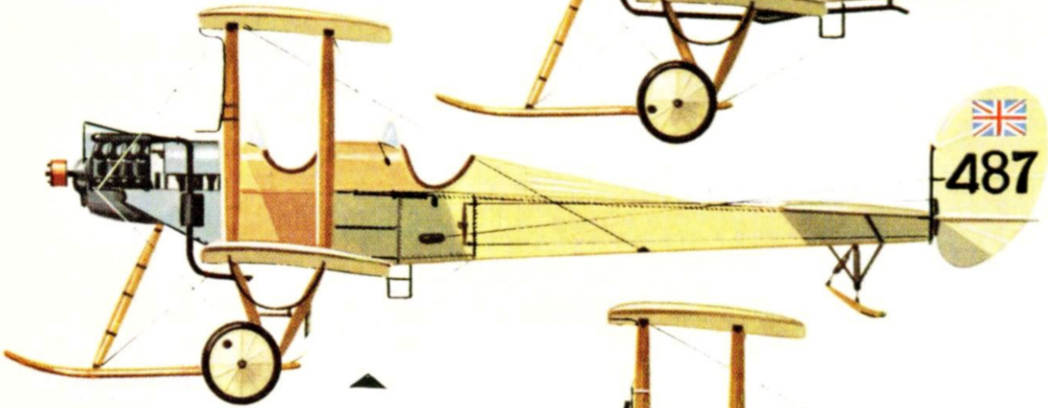


B.E.2a, No. 347, of No. 2 Sqn., R.F.C. The first British aircraft to land on continent of Europe after the outbreak of war, flown by Lt. H. D. Harvey-Kelly.



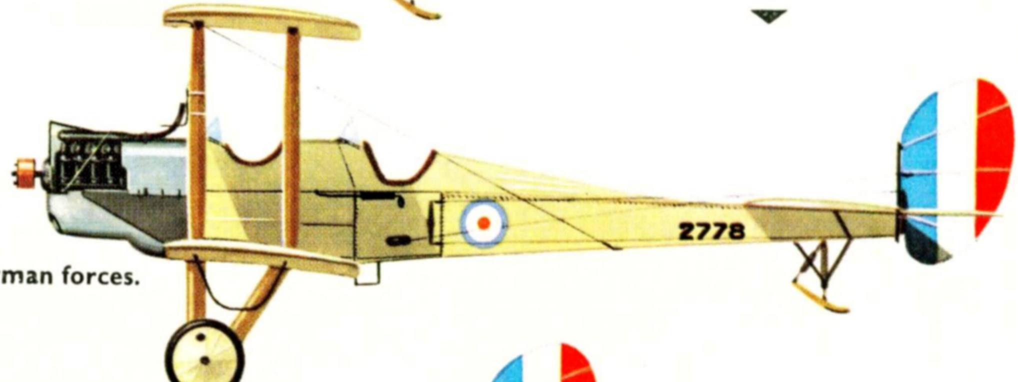
B.E.2a, No. 470, Central Flying School, Upavon, summer 1914. Note a.s.i. pressure head positioned above port wing; also rear cockpit windscreen. Subsequently used operationally by Nos. 6 and 9 Sqns., R.F.C. in France, and crashed 15th December 1914.

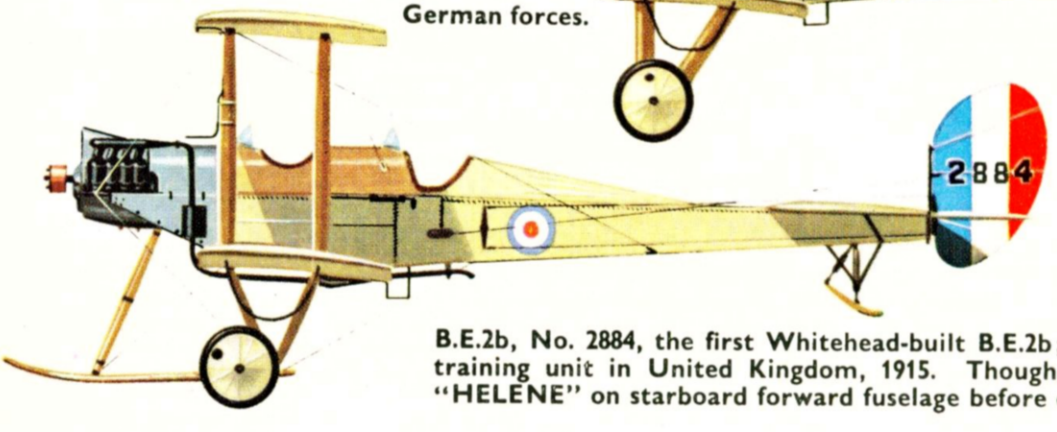




B.E.2b, No. 487; France, 1914. Note bomb rack between undercarriage V- struts. Aircraft subsequently captured intact by German forces.

B.E.2b, No. 2778, served with unidentified training unit in United Kingdom, 1915. Note V-strut undercarriage, and cowled engine sump; engine cowling probably salvaged from a B.E.2c.





B.E.2b, No. 2884, the first Whitehead-built B.E.2b; served with unidentified training unit in United Kingdom, 1915. Thought to have carried legend "HELENE" on starboard forward fuselage before delivery to Farnborough.

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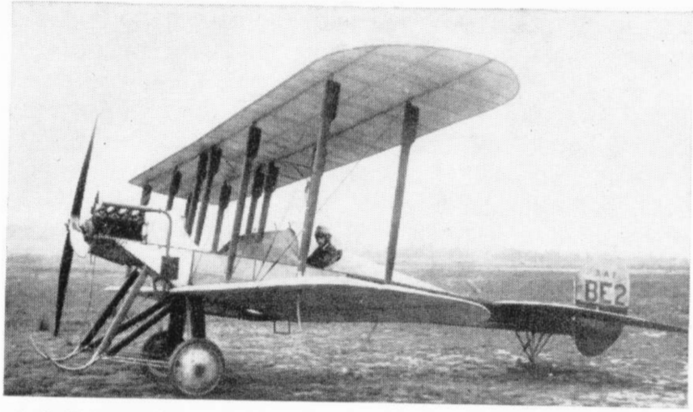


A B.E.2a with an early type of oleo undercarriage and fitted with the fin struts designed by Edward Busk.
(Photo: Imperial War Museum Q 57614)

given to Armstrong Whitworth, the Coventry Ordnance Works, Handley Page and Hewlett & Blondeau.

In the pre-war period the B.E.2a was used by Squadrons Nos. 2, 4 and 6. During its first months of existence the entire Military Wing of the R.F.C. was at Farnborough and Salisbury Plain, but in February 1913 No. 2 Squadron became the first unit to be sent to a new station. This was at Montrose and, despite the great distance from Farnborough and the unfavourable weather, five of the unit's officers flew all the way. Two of the aircraft were B.E.2a's, flown by Captain J. H. W. Becke and Lt. C. A. H. Longcroft (later Air Vice-Marshal Sir Charles Longcroft, K.C.B., C.M.G., D.S.O., A.F.C.). The aircraft left Farnborough on 13th February 1913 and, after many adventures, reached Montrose on the 26th. Becke had flown *217*; Longcroft's aircraft must almost certainly have been *218*, which he flew for the first time on the day of the squadron's departure from Farnborough.

The B.Es of Squadrons Nos. 2 and 4 were active in 1913, putting in a remarkable number of flying hours. No. 2 Squadron's stay at Montrose was marred by the death of Lt. Desmond Arthur on 28th May 1913, when the erstwhile B.E.5, No. *205*, broke up in the air owing to the failure of a faulty repair that had been made to a damaged spar. Arthur's death was later claimed by some to be connected with the several appearances in 1916 of the so-called Montrose Ghost, during the period between the interim and final reports of the Bailhache enquiry into the administration and command of the Royal Flying Corps. The appearances of the ghost of an officer in flying kit between August and the end of 1916 seem to have been about as well authenticated as these things can be, but the apparently arbitrary connection of the apparition with Desmond Arthur now looks somewhat like an attempt to diminish the findings of the Bailhache enquiry (which substantially rebutted the criticisms of the Royal Aircraft Factory designs brought by its detractors) by casting belated aspersions on the B.E. aircraft.

There is in fact no reason to suppose that in their serviceability and reliability those early B.Es were any worse than their contemporaries. The units using the type amassed respectable totals of flying hours, and the frequent use of individual B.Es in respect of which records have survived suggests a standard of serviceability that must have been very good at the time. On 27th March 1914 No. 2 Squadron, still at Montrose, reported that its B.Es had flown a total of 1,300 miles on that one day.

Great distances were by then something of a tradition in No. 2 Squadron. On 22nd May 1913 Captain Longcroft flew *273* from Farnborough to Montrose in one day. Including two intermediate stops his total time for the 550 miles was 10 hours 55 minutes. On 19th August 1913 Longcroft, with Col. F. H. Sykes as passenger, flew from Farnborough to Montrose in B.E.2a *225* in 7 hours 40 minutes. The aircraft was fitted with an additional fuel tank and made only one stop, at Alnmouth.

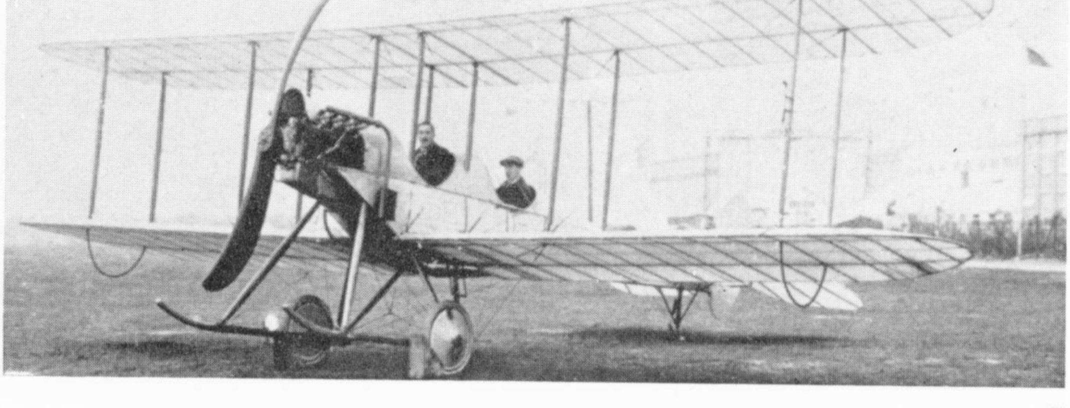
On 22nd November 1913 Longcroft did even better. His B.E.2a, *218*, was fitted with an additional fuel tank in the front cockpit, which was then neatly faired over. This installation was the work of First Class Air Mechanic H. C. S. Bullock. On the modified aircraft Longcroft flew non-stop from Montrose to Portsmouth and back to Farnborough; the total distance was about 650 miles, the total flying time 7 hours 20 minutes.

By early December 1913, No. *230* of No. 2 Squadron had been modified in much the same way as *218*. An extra petrol tank holding 53 gallons was installed in the front cockpit and a gravity tank was slung under the centre section as on B.E.1 and B.E.2.

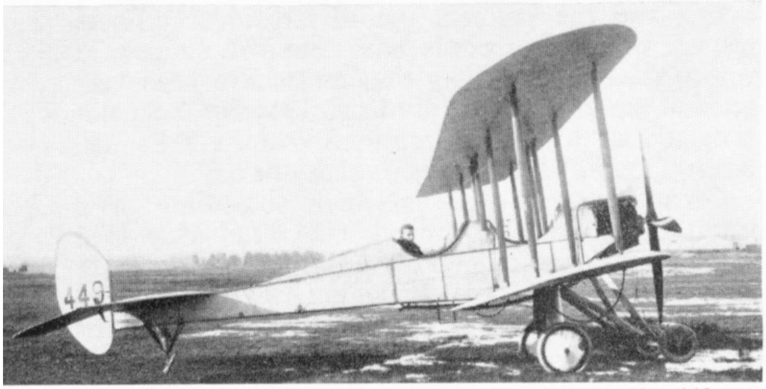
The Royal Aircraft Factory conducted several experiments with B.E.2a aircraft. The type was used as a test vehicle for oleo undercarriages in the months preceding the war. At least three types of undercarriage were tested, but it is uncertain how many B.Es were involved in the trials. Two that are known to have had oleo undercarriages are *206* and *449*. The earlier oleo undercarriage had two curved frontal skids on V-struts, at the apices of which were pivoted the double radius rods to the axle; the oleo legs constituted the rear members of the undercarriage structure.

At one time a B.E.2a fitted with this form of undercarriage was also provided with a set of experimental interplane struts that had appreciably increased chord at their upper ends. These fin struts were designed by E. T. Busk (see below) as part of his experiments in the investigation of aircraft stability.

By December 1913 an improved oleo undercarriage had been evolved and was tested on a B.E.2a. The twin forward skids were replaced by a single frontal wheel supported on a system of V-struts, and the undercarriage was in effect the prototype of that fitted to the F.E.2a, F.E.2b, R.E.7 and some B.E.2c's. A B.E.2a that was fitted with this undercarriage also had a modified tail unit. A completely new tailplane



A B.E.2a at the Royal Aircraft Factory, fitted with an experimental two-blade airscrew.
(Photo: from J. J. Carroll)



The oleo undercarriage here seen on the B.E.2a No. 449 *was basically similar to that fitted to the aircraft illustrated overleaf, but had two fairly substantial wheels fitted to the forward skids to prevent nosing-over. This photograph is dated 28th November 1913.* (Photo: Crown copyright)

was mounted under the upper longerons, its spars passing through the rear fuselage. This tailplane was of greater span than the standard surface and was braced by four struts to the top of the rudder post. This in turn was given a forward strut, and the triangular area thus formed was covered with fabric to form a small fin.

One of the Royal Aircraft Factory's most distinguished scientists was Edward Teshmaker Busk who, on 10th June 1912, took up an appointment at Farnborough as an assistant engineer physicist. He had taken the Mechanical Sciences tripos at Cambridge in 1907 and had had an early interest in flying. He embarked on a course of flying in February 1912 at the Hendon school of the Aeronautical Syndicate Ltd., where he flew the curious canard Valkyrie monoplanes.

When at Farnborough he became deeply interested in the problems of stability in aircraft and experimented over a long period with the object of producing an inherently stable aeroplane. He began his experiments on B.E.2a's and made particularly extensive use of No. *601*. At one time this B.E. had two large fin surfaces above the centre section; its tailplane was a long-span rectangular surface mounted on top of the upper longerons. Landing wires were fitted to the tailplane, their upper ends being anchored to the apex of an inverted-V kingpost on the centre line.

Busk died, prematurely and tragically, on 5th November 1914, when his aircraft caught fire in flight over Laffan's Plain. According to *The War in the Air*, Vol. I, page 167, and Vol. III, page 261, he was flying a B.E.2c fitted with the prototype R.A.F.1 engine on that occasion, but surviving records at the R.A.E., Farnborough, state that his aircraft was B.E.2 (*sic*) No. *601*. This apparent discrepancy may be explained by two R.A.F. drawings for B.E.2a aircraft: No. A3819 was of a "Muff bracket to suit R.A.F. 8 cylinder engine"; A4197 is listed as "G.A. of fuselage (converted to B.E.2c)". It is thus possible that No. *601* might have been totally reconstructed to become a B.E.2c, but conclusive evidence of this has yet to be discovered. What was beyond doubt was that, with Busk's untimely death, the Factory lost a most valuable scientist.

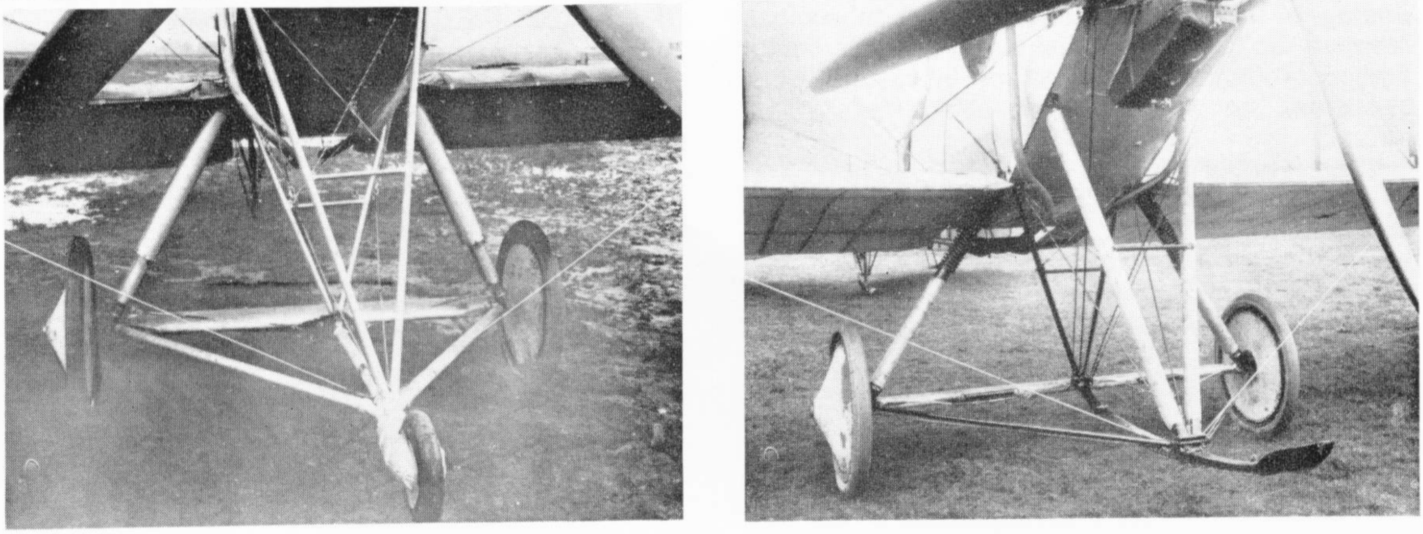
The B.E. design had continued to develop in the months before the war started. Early in 1914 the B.E.2b was designed with an improved fuselage that gave the crew greater protection. A deeper top decking and closer coaming of the cockpits offered a little more comfort; and the arrangement of the elevator and rudder controls was revised. Wing warping was retained for lateral control, and the 70 h.p. Renault remained the standard engine.

When war came the R.F.C. followed the B.E.F. to France and the Eastchurch squadron of the R.N.A.S. went to Dunkerque, commanded by the redoubtable Commander C. R. Samson. Squadrons Nos. 2 and 4 of the R.F.C. were equipped throughout with B.E.2a's and 2b's and flew their aircraft to France on 13th August 1914. The distinction of being the first British aircraft to land on French soil after the outbreak of war fell to B.E.2a No. *347*. Its pilot was Lieutenant H. D. Harvey-Kelly, who took off from Dover at 6.25 a.m. and landed near Amiens at 8.20 a.m.

On 27th August Samson's Eastchurch Squadron flew to Ostend, its equipment consisting of two B.E.s, two Blériot monoplanes, one Bristol T.B.8, one Henri Farman, Short No. *42*, and two 80 h.p. Sopwiths. The B.E.s included No. *50*, which had been built by Hewlett and Blondeau and was originally intended for the R.F.C. It was transferred to the R.N.A.S. at Eastchurch in January 1914 and became Samson's personal aircraft. For a time its front cockpit was occupied by a large cylindrical petrol tank, and in this form Samson flew it during the 1914 review of the Fleet at Spithead.

Samson's squadron stayed only a few days at Ostend and conducted their operations from Dunkerque. Samson regarded his B.E., No. *50*, with real

Left: *The oleo undercarriage fitted to this B.E.2a was basically that which was later fitted to the F.E.2a, 2b, 2c, 2d, R.E.7 and some B.E.2c's. Photograph dated 11th December 1913.* Right: *Also dated 11th December 1913, this photograph depicts another form of oleo undercarriage fitted to a B.E.2a.* (Photos: Crown copyright)



affection. On the orders of Winston Churchill, then First Lord of the Admiralty, a unit of Samson's squadron was detached to Antwerp for the purpose of bombing the Zeppelin sheds at Düsseldorf and Cologne. When a gale wrecked this flight's aircraft Samson had to replace them

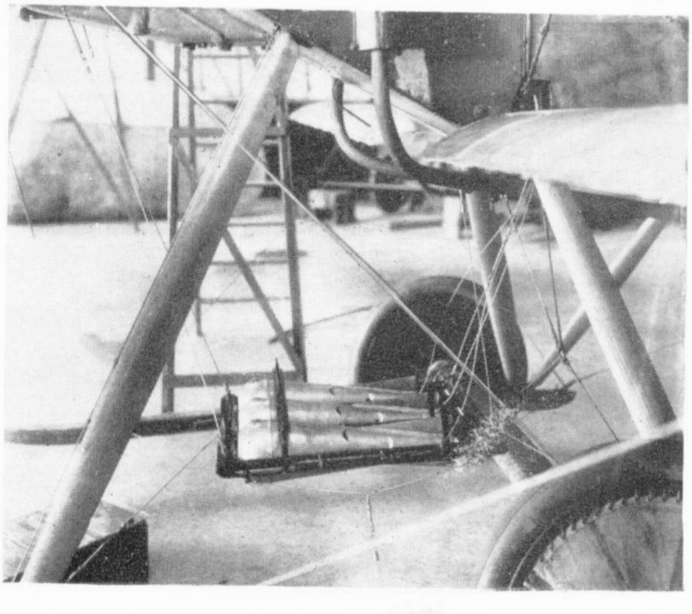
> " . . . with the best aeroplanes we could scrape up from my squadron. I sent Gerrard the three best machines we had, one of them being No. *50*, my own, which I had flown for over a year. It was a great wrench parting with her; but the Antwerp scheme was all-important. I fully expected never to fly her again; but fortunately she was returned to me after Antwerp fell, and I flew her during the remainder of our stay in France, and also at the Dardanelles, where she was the sole survivor of our original 1914 machines. She went right through the Dardanelles campaign, doing a lot of useful work, though at the last I must say I only flew her occasionally simply for old acquaintance' sake".*

In France No. *50* was armed with a rifle, and incendiary bullets were carried for attacks on enemy airships. This B.E. made several bombing attacks on enemy installations at Ostend, Zeebrugge and Middelkerke.

On arrival at Tenedos aerodrome No. *50* was quickly assembled on 26th March 1915. Samson described the difficulties of handling his squadron's Maurice Farmans which, stowed in packing cases 47 ft. long, presented problems of disembarkation.

> "No. *50* was of course easy to handle. She was hoisted out, put in a launch, and run ashore on her own wheels. As soon as we got her to the aerodrome, half a dozen of my best men got her ready for flight, and that evening I made a test flight on her . . . [On 2nd April] I started bombing the Turks, dropping three small bombs on the Soghon Dere Minefield batteries. I didn't hit anything; but it was good practice, and I felt it was time the Turks realised that Eastchurch had arrived on the scene."†

No. *50* had had the extra petrol tank removed from her front cockpit by the time she reached Tenedos, and her assorted duties during the Dardanelles campaign included spotting for naval ships' guns. On such occasions Samson carried an observer. As late as 18th September 1915 he "took No. *50* and bombed ships in Berghaz Liman with a 100 lb. bomb"; and on the following night he attacked Kilia Liman in the venerable B.E.



An early attempt to provide a bomb rack for the B.E.2a. This device was made at the Royal Aircraft Factory in the early weeks of the war. The photograph is dated 4th October 1914. (Photo: Crown copyright)

The staff of the Royal Aircraft Factory realised that operational aircraft would have to be adapted to enable them to fly in conditions that would have kept them grounded in times of peace. By 8th February 1915 they had designed and made a ski undercarriage for B.E.2a and 2b aircraft (presumably it would have fitted the early B.E.2c undercarriage also); but evidence of its use has yet to be found. Skis were later fitted to a B.E.8 and doubtless resembled the B.E.2a/b equipment.

The first award of the Victoria Cross to a member of the British flying services was to Lieutenant W. B. Rhodes-Moorhouse of No. 2 Squadron, R.F.C. On 26th April 1915, during the Battle of Neuve Chapelle, he was ordered to bomb the railway junction at Courtrai with the object of preventing enemy troop reinforcements from being brought forward by rail. His aircraft was one of the early B.E.s; his load a single 100 lb. bomb. To make sure of his target he attacked from a height of only 400 ft. and came under intense ground fire. Immediately after dropping his bomb he was severely wounded but managed to fly back to his squadron's aerodrome at Merville. He made out a full report before going to hospital, but died of his wounds on the following day. His V.C. was awarded posthumously.

The B.E.2a and 2b remained in squadron service well into 1915. By 31st August, however, their operational career on the Western Front was virtually over, and only five were with the R.F.C. in France. No. 4 Squadron had *368*, listed as a B.E.2a, and *493* and *746* as B.E.2b's; No. 8 Squadron had the B.E.2a *336*, while No. 6 Squadron's declared strength included the veteran *206*. By that time it had been fitted with a V-type undercarriage of B.E.2c pattern, and its long career ended next month in a crash. On 31st August, in addition to the B.E.s with the squadrons the 1st Aircraft Park had the B.E.2b's *484* and *492* in reserve and *396* was under repair.

No serious criticism of the performance of the early B.E.s in that first year of the war has been recorded, despite the pre-war strictures of the Factory's critics. On the contrary, Lord Douglas of Kirtleside, writing in *Years of Combat*, said:

> "The aircraft used by the flight in No. 2 Squadron in which I was to serve were the B.E.2a and B.E.2b. Originally designed and built as early as 1911, they evolved from a great deal of experimental work, and they were the first of the practical machines supplied to the Royal Flying Corps . . .
>
> "Our two-seater B.E.2a's and b's were sturdy biplanes, and even though they were primitive enough they at least had the promise of the shape that the aeroplane was to take in the very near future. The pilot sat in the back seat and the observer in the front, which was an inconvenient and clumsy arrangement and the wrong way around, and we would fly over the batteries with which we were to work at a height of between three and four thousand feet. Calling them up by signalling with the lamp, which was always a struggle for the observer because he had to manipulate a cumbersome contraption in the full blast from the propeller, we would let them know that we were ready to go to work, and we would continue signalling to them the results from the shells which they would fling over, with any corrections that were

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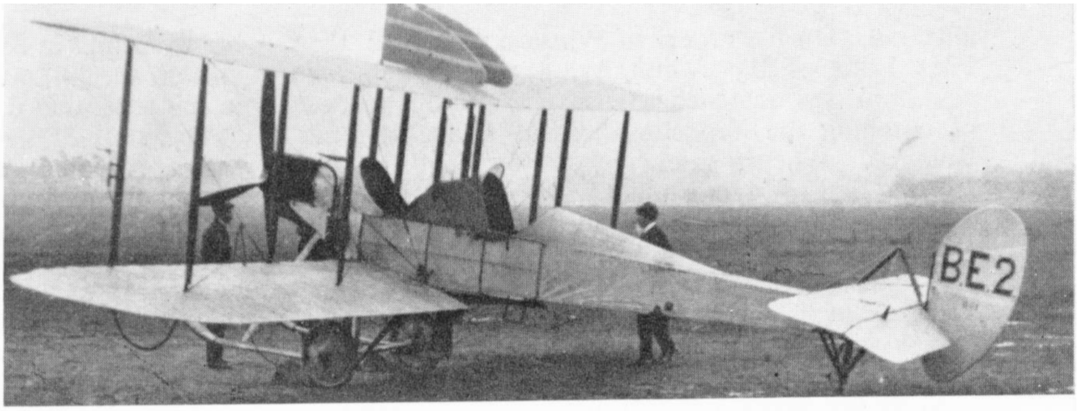
Fights and Flights, p.45.

†*Fights and Flights*, pp. 220 and 222.

B.E.2a No. 601, used by Edward Busk in his experiments in inherent stability. The aircraft had at this time two fin surfaces above the centre section and was fitted with a high-aspect-ratio rectangular tailplane, braced from a central inverted-V kingpost.



needed. We would fly backwards and forwards between the batteries and the targets, and the whole business was really quite effective so long as we had reasonably good visibility."*

At that time Lord Douglas was an observer and he was one of the pioneers of photographic reconnaissance. He cut a rectangular hole in the floor of his cockpit in the B.E.2a "and his practice, when the area to be photographed nearly filled the aperture, was to push his camera through the hole and take his snapshot."†

When the B.E.2 was designed little thought, if any, was given to the possibility of arming reconnaissance aircraft. Although Farnborough developed the F.E.2 gun carrier at more or less the same time as the B.E.2 family, no serious efforts were made to evolve gun mountings for the B.Es. Thus it was that Lord Douglas came to write:

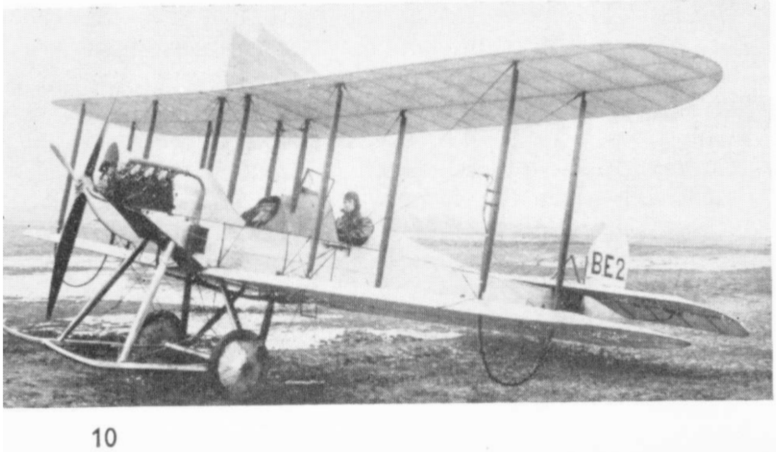
> "Our armament in the air was largely a matter of personal choice, and it consisted of either a Colt automatic or a cavalry carbine. But even the weight of these weapons proved at times to be a nuisance. In the official history there is an account that I put on record of the first time that I ever came across a German machine at close quarters in the air. . . . In it I stated:
>
> '. . . both the pilot and myself were completely unarmed. Our machine had not been climbing well, and as I was considered somewhat heavy for an observer, Harvey-Kelly told me to leave behind all unnecessary gear. I therefore left behind my carbine and ammunition. We were taking photographs of the trench system to the north of Neuve Chapelle when I suddenly espied a German two-seater about a hundred yards away and just below us. The German observer did not appear to be shooting at us. There was nothing to be done. We waved a hand to the enemy and proceeded with our task. The enemy did likewise. At the time this did not appear to me in any way ridiculous—there is a bond of sympathy between all who fly, even between enemies. But afterwards just for safety's sake I always carried a carbine with me in the air. In the ensuing two or three months I had an occasional shot at a German machine. But these encounters can hardly be dignified with the name of "fights". If we saw an enemy machine nearby, we would fly over towards it, and fire at it some half-dozen rounds. We scarcely expected to shoot the enemy down; but it was a pleasant break in the monotony of reconnaissance and artillery observation. I remember being surprised one day to hear that an observer of another squadron (his name, Lascelles, sticks in my memory to this day, though I never met him), had shot down a German machine in our lines with a rifle.' "*

After their withdrawal from operational service the early B.Es were used for training purposes. Limited production of the B.E.2b continued into 1916: aircraft of the batch *2175–2180* were inspected at Farnborough on various dates between 7th October 1915 and 28th April 1916. The first Whitehead-built B.E.2b, *2884*, was completed in November 1915 and was reported to be at Farnborough on 18th December 1915, the last (*2889*) on 2nd February 1916. It is known that *2887* was used at Filton in the spring of 1916, and *2885* was still in service with No. 16 Reserve Squadron, Beaulieu, in 1917. It seems that the final deliveries were of the ten B.E.2b's built by the Joucques Aviation Co.; of these, *2770* was at Farnborough on 6th May 1916, *2789* on the following 5th October, and *2784* on 7th October.

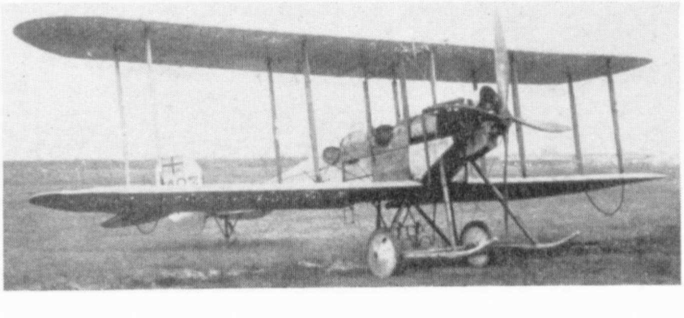
Several B.E.2b's were fitted with V-type undercarriages, and it has been reported that some had ailerons in place of wing warping. Satisfactory evidence of this last modification has not yet been found.

The last B.E.2b seems to have been *A376*, which may have been assembled from spares or components of wrecked aircraft. It survived the war, and on 23rd January 1919 was recorded at Farnborough, powered by the 80 h.p. Renault engine No. 214/2081, having been rebuilt in the latter half of 1918. This was one of the B.E.2b's that were fitted with V-type undercarriages. It was ready to fly on 30th January 1919 but

Another view of No. 601 with a greatly enlarged windscreen for the rear cockpit. (Photo: Imperial War Museum MH 3229)



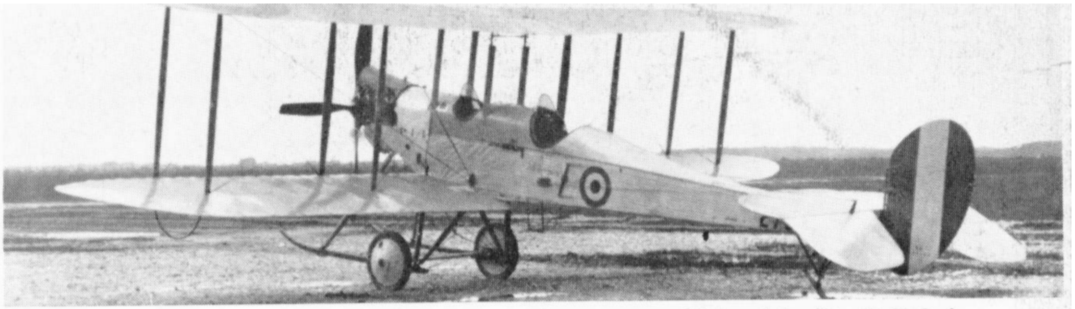
B.E.2b No. 487 had another form of bomb rack under the fuselage between the rear V-struts of the undercarriage. The aircraft is here seen in German hands, having been captured intact.



**Years of Combat*, pp. 67 and 74.

†*The War in the Air*, Vol. II, p. 89.

**Years of Combat*, pp. 76-77.



A Joucques-built B.E.2b of No. 16 Reserve Squadron, Beaulieu, still in service in 1917 for training purposes. (Photo: Royal Canadian Air Force RE 64-476)

was later dismantled and was handed over to the Southern Aeroplane Repair Depot on 28th February 1919.

Once the war had started the Royal Aircraft Factory quite naturally used B.E.2c's and later variants, rather than the obsolete B.E.2a's and 2b's, in their wide-ranging experiments with armament, instruments and equipment; but at least one remarkable device was fitted experimentally to one of the early B.Es. Lord Douglas has recorded (*Years of Combat*, pages 63–64) that "In the retreat from Mons one of the pilots of No. 3 Squadron conceived the idea of dangling a hand grenade from a long piece of cable in front of an enemy aircraft, trying to get it to explode when the grenade became entangled in the propeller of the other machine."

Whether inspired by this idea or not, the Royal Aircraft Factory produced a fearsome anti-airship device known as the Fiery Grapnel. This was recalled by H. L. Stevens, F.R.Ae.S, who had worked on the weapon at Farnborough, in the January 1966 issue of the Journal of the Royal Aeronautical Society:

> "This consisted of a hollow steel shaft about two inches in diameter containing explosive. It was fitted with a sharp four-sided pyramid at the nose and had four flukes with sharp points at the back, their curves filled in with flat plates to act as stabilising fins. It was to be lowered on a wire by a winch in a B.E. aeroplane. The idea was to fly across the Zeppelin so that the wire hit it; the grapnel would then fly around and bury its nose in a gas-bag, explode, and 'Bob's your uncle'. Unfortunately, G. I. Taylor demonstrated by a very ingenious experiment in the wind tunnel that, unless a direct hit was scored, the cable would inevitably break in the swinging round process and the grapnel would disappear harmlessly into space. I believe the first four aeroplanes to be fitted with the device were captured by the Germans in Antwerp."

Experiments with Grapnels continued for a time but the weapon was abandoned. Apart from G. I. Taylor's demonstration of its impracticability, effective incendiary ammunition for conventional machine guns was in prospect.

Few of the early B.Es. saw service outside France. Two were with Samson's squadron during the Dardanelles campaign; two Bristol-built B.E.2a's had been sent to Australia in 1914 and were used at the flying school at Point Cook. A few others were delivered to the Indian Flying School at Sitapur, and one of these was sent to Egypt in December 1914 to help reinforce the Ismailia Flight of the R.F.C. This aircraft participated in the bombing of El Murra on 16th April 1915.

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SPECIFICATION

Power: B.E.1.—60 h.p. Wolseley, 60 h.p. Renault. B.E.2, 2a and 2b.—70 h.p. Renault. The erstwhile B.E.5 (No. *205*) had a 60 h.p. E.N.V. Type F engine at one time.

Dimensions: Span 35 ft. 0½ in. (upper wing of early B.E.2a was 38 ft. 7½ in.), length 29 ft. 6½ in., chord 5 ft. 6 in. The stagger on official drawings is shown as nil, but official notes on rigging the aircraft required a negative stagger of 1½ to 2 in. Incidence 3 deg. at centre section, with slight wash-out towards each wing tip. Span of tail 12 ft.; wheel track 6 ft. 2 in.; tyres 26 in. by 2½ in.; airscrew diameter 8 ft. 10 in.

Areas: Wings, originally 374 sq. ft., later 352 sq. ft.; elevators 25 sq. ft.; rudder 12 sq. ft.

Armament: There was no standard armament. On active service pilots and observers carried rifles, carbines or pistols, and hand grenades, light bombs or one 100-lb. bomb were occasionally carried.

PRODUCTION

It is virtually impossible now to determine the exact number of B.E.2, 2a and 2b aircraft that were made. Moreover, it is impossible to say that any individual aircraft was and remained at all times a B.E.2a: there were several conversions to B.E.2b. Contractors were as follows, but the serial number of aircraft known to have been made by these firms are by no means complete.

Royal Aircraft Factory, Farnborough, Hants.: 46, 47, 201, 202, 205, 220, 267, 272.

Sir W. G. Armstrong, Whitworth & Co., Ltd., Gosforth, Newcastle-on-Tyne.

British & Colonial Aeroplane Co., Ltd., Filton, Bristol: Built a total of nineteen B.E.2a's and 6 B.E.2b's, including B.E.2a's *217–218* and *225–241* and B.E.2b's *396, 397* and *487*. (The B.E.2a's *273* and *449* have also been reported as Bristol-built).

Coventry Ordnance Works, Ltd., Coventry.

Handley Page. Ltd., 110 Cricklewood Lane, London, N.W.

Hewlett & Blondeau Ltd., Omnia Works, Clapham, London, S.W.: Built the B.E.2a's *49* and *50*.

The Joucques Aviation Works, 9A Hythe Road, Willesden, London N.W.10: Built twenty B.E.2b's, *2770–2789*.

Vickers Ltd., Imperial Court, Basil Street, Knightsbridge, London S.W. (production at Vickers' Erith works): Built a total of 31 B.E.2a's including *222, 441, 442, 447, 452–454*.

Whitehead Aircraft Co., Ltd., Old Drill Hall, Townshend Road, Richmond: Built six B.E.2b's, *2884–2889*.

Other serial numbers known to have been allotted to B.E.2a and B.E.2b aircraft were *206, 209, 249, 250, 276, 298, 299, 303, 314, 316–318, 320, 321, 327–336, 340, 347–349, 368, 372, 385, 407, 457, 465, 466, 468–481, 483–486, 488, 492, 493, 601, 646, 666, 667, 687, 705, 709, 733, 746, 2175–2180, A376*.

SERVICE USE

Pre-war: R.F.C. Squadrons No. 2, 3, 4 and 6; Eastchurch Squadron of the R.N.A.S.

Wartime: R.F.C. Squadrons Nos. 2, 4, 6 and 16; No. 9 (Wireless) Squadron (which existed from 8th December 1914 until late March 1915; the No. 9 Squadron that arrived in France on 20th December 1915 equipped with B.E.2c's, was an entirely separate unit). All these R.F.C. squadrons operated in France. The R.N.A.S. Eastchurch Squadron flew operationally from Dunkerque from September 1914 until March 1915; thereafter it flew its assorted aircraft, including two B.E.2a's, as No. 3 Squadron R.N.A.S. from Tenedos and Mudros in the Aegean area.

Egypt: Ismailia Flight, R.F.C. *India:* Indian Flying School, Sitapur.

Australia: Australian Flying School, Point Cook.

Examples of B.Es used by squadrons

No. 2 Sqn., R.F.C.—201 (later by No. 4 Sqn.), *205, 217, 218, 222, 225, 228, 229, 230, 232, 233, 235, 267, 272, 273, 276, 327, 328, 331, 332, 336, 347, 368, 372, 396, 492* (June–July 1915; previously with No. 6 Sqn.), *666, 733*.

No. 3 Sqn., R.F.C.—209, 220, 226.

No. 4 Sqn., R.F.C.—201 (previously by No. 2 Sqn.), *234, 299, 314, 317, 336, 368, 493, 705, 746*.

No. 6 Sqn., R.F.C.—206, 234, 238, 239, 241, 242, 317, 329, 336, 368, 468, 470, 484, 488, 492 (October 1914; later with No. 2 Sqn.), *646, 667*.

No. 9 Sqn., R.F.C.—231, 234, 238, 241, 317, 336, 368, 470, 484, 733.

*No. 16 Sqn., R.F.C.—*Reported to have *368* on charge on 30th June 1915.

R.N.A.S. Eastchurch Sqn., later No. 3 Sqn., R.N.A.S.—46, 49, 50.

Central Flying School, Upavon—441, 442, 447, 449, 453, 454, 457, 465, 468, 470.

WEIGHTS

B.E.2: Weight empty 1,050 lb., loaded 1,650 lb.

B.E.2a: Weight empty 1,274 lb., loaded 1,600 lb.

PERFORMANCE

B.E.2 (*as at Military Trials*): Maximum speed 73 m.p.h. at ground level; climb to 1,000 ft. 2 mins. 55 secs.; to 7,000 ft. 35 mins.

B.E.2a: Maximum speed 70 m.p.h. at ground level, 65 m.p.h. at 6,500 ft.; climb to 3,000 ft. 9 mins., to 7,000 ft. 35 mins.; service ceiling 10,000 ft.; endurance 3 hours.

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